

REMARKS

Upon entry of the Amendment, Claims 1-13 and 25-26 will be pending in the application.

Amendment to Claim 1 is discussed herein.

Nonelected, withdrawn Claims 14-24 are canceled without prejudice to the filing of a divisional application thereon.

Entry of the Amendment is respectfully requested along with reconsideration and review of the claims on the merits.

Allowable Subject Matter

Applicant appreciates the Examiner's indication that Claims 25-26 are objected to as being dependent upon a rejected base claim, but would be patentable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

In response, Applicant rewrites Claims 25-26 into independent form, as shown in the Amendment to the Claims. Accordingly, Applicant respectfully requests allowance of at least Claims 25-26.

Response to Claim Rejections - 35 U.S.C. § 103

A. Claims 1-7 and 9-11 are rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Lee (US 2003/0067077) in view of Lauterbach et al (US 6,313,517), for the reasons given in the Office Action.

The Examiner cites Lee as disclosing an adhesive film made of benzocyclobutene polymer (BCB) having a benzene ring in its molecule and having a specific dielectric constant of

about 2.7. The Examiner asserts that the dielectric constant of “about 2.7” allows for the dielectric constant slightly below 2.7.

B. Claims 12-13 are rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Lee and Lauterbach et al as applied to claim 10, above, and further in view of Aoki et al (US 6,787,480), for the reasons given in the Office Action.

C. Claims 1-12 are rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Barth et al (US 2004,0173908) in view of Lee (US 2003/0067077), for the reasons given in the Office Action.

Applicant responds as follows.

Regarding the rejection of Independent Claim 1 based on either the combination of Lee with Lauterbach or Barth with Lee, Applicant respectfully traverses the obviousness rejections on the basis that none of the references to Lee, Lauterbach, and Barth discloses or suggests, alone or in combination, the presently claimed invention.

Applicant amends Claim 1 to clarify the structure of the present invention. The present invention is a semiconductor device having a semiconductor substrate which acts as a first copper diffusion barrier layer, a first low dielectric constant film, a SiO₂ layer, a second copper diffusion barrier layer, and an interlayer dielectric film formed above said second copper diffusion barrier layer, where the interlayer dielectric film includes a lamination of an adhesive film constituted essentially by a silicon-based compound having an aromatic ring in a molecule of said silicon-based compound having a specific dielectric constant of 2.5 to 2.6 and a second low dielectric constant film contacting said adhesive film, according to Claim 1. For example,

Figure 4 of the present application and the accompanying description in the specification at pages 10-12 discloses each of these elements. No new matter is added. Entry of the amendment is respectfully requested.

The Examiner cites Lee' semiconductor device structure. However, Lee fails to disclose at least Applicant's semiconductor device having a SiO₂ layer, a second copper diffusion barrier layer, and an adhesive film constituted essentially by a silicon-based compound having an aromatic ring in a molecule of said silicon-based compound having a specific dielectric constant of 2.5 to 2.6, where the second copper diffusion barrier layer is separate from the adhesive film, according to Claim 1. Lee discloses a semiconductor substrate (100), a first dielectric layer (110), an organic copper diffusion barrier layer comprising at least a benzocyclo polymer (118), a second dielectric layer (120) made of a low-k dielectric material. See Lee's Fig. 1I, and page 2, [0014]-[0021]. In other words, Lee teaches only one copper diffusion barrier layer which also contains a benzocyclo polymer.

Lauterbach fails to make up for Lee's deficiency. Thus, Lee, and the combination of Lee with Lauterbach, fails to disclose or teach the product by process element as presently claimed.

The structure of Applicant's invention provides unique benefits. Using the description of one embodiment in Fig. 4 for illustration, Applicant discovered, for example, that a BCB layer 110, similar to the SiCN layer 108, is capable of preventing diffusion of the copper and therefore, the SiCN layer can be formed thinner by a thickness of the BCB layer that is inserted between the SiCN layer 108 and the MSQ layer 112. Inserting a BCB layer provides the benefit of reducing a parasitic capacitance between interconnect lines. (see page 11, lines 12-25).

Regarding the combination of Barth with Lee, the Examiner cites to Barth's Fig. 2 for the semiconductor device structure, including disclosing an adhesive film 118 (see Barth, [0033]), but recognizes that "Barth does not disclose that the adhesive film 118 is a silicon-based compound of BCB having an aromatic ring." (see Office Action, page 5, first full paragraph). The Examiner asserts that Lee makes up for Barth's deficiencies.

However, Applicant submits that even if Lee's BCB containing layer were incorporated into Barth's structure, Barth's structure would still fail to make up for Lee's deficiencies as previously described. Thus, the combination of Barth with Lee fails to disclose or suggest the presently claimed invention.

Applicant submits that the dependent Claims 2-13 are patentable for at least the same reasons as given above for the patentability of independent Claim 1.

Accordingly, Applicant respectfully requests reconsideration and withdrawal of the obviousness rejections.

Conclusion

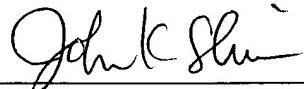
In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

AMENDMENT UNDER 37 C.F.R. § 1.116
U.S. Appln. No.: 10/646,709

Atty. Docket No.: Q76993

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



John K. Shin
Registration No. 48,409

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE
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